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# ParlaMint II: advancing comparable parliamentary corpora across Europe

Tomaž Erjavec[1] · Matyáš Kopp[2] · Nikola Ljubešić[1,9] · Taja Kuzman[1] · Paul Rayson[3] · Petya Osenova[4] · Maciej Ogrodniczuk[5] · Çağrı Çöltekin[6] · Danijel Koržinek[7] · Katja Meden[1,8,9] · Jure Skubic[9] · Peter Rupnik[1] · Tommaso Agnoloni[10] · José Aires[11] · Starkaður Barkarson[12] · Roberto Bartolini[13] · Núria Bel[14] · María Calzada Pérez[15] · Roberts Darģis[16] · Sascha Diwersy[17] · Maria Gavriilidou[18] · Ruben van Heusden[19] · Mikel Iruskieta[20] · Neeme Kahusk[21] · Anna Kryvenko[9,22] · Noémi Ligeti-Nagy[23] · Carmen Magariños[24] · Martin Mölder[25] · Costanza Navarretta[26] · Kiril Simov[4] · Lars Magne Tungland[27] · Jouni Tuominen[28] · John Vidler[3] · Adina Ioana Vladu[24] · Tanja Wissik[29] · Väinö Yrjänäinen[30] · Darja Fišer[9]

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## Abstract

The paper presents the results of the ParlaMint II project, which comprise comparable corpora of parliamentary debates of 29 European countries and autonomous regions, covering at least the period from 2015 to 2022, and containing over 1 billion words. The corpora are uniformly encoded, contain rich metadata about their 24 thousand speakers, and are linguistically annotated up to the level of Universal Dependencies syntax and named entities. The paper focuses on the enhancement made since the ParlaMint I project and presents the compilation of the corpora, including the encoding infrastructure, use of GitHub, the production of individual corpora, the common pipeline for producing their distribution, and use of CLARIN services for dissemination. It then gives a quantitative overview of the produced corpora, followed by the qualitative additions made within the ParlaMint II project, namely metadata localisation, the addition of new metadata, such as the political orientation of political parties, the machine translation of the corpora to English and its tagging with semantic classes, and the production of pilot speech corpora. Finally, outreach activities and further work are discussed.

**Keywords** Parliamentary proceedings · Comparable corpora · TEI

Extended author information available on the last page of the article

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## 1 Introduction

Parliamentary proceedings, i.e. transcripts of debates in the highest democratic body of a country or autonomous region, have two characteristics that make them an especially good text type to compile into language corpora. Given the huge impact of their content, they are, on the one hand, of interest to a wide spectrum of researchers from political science, history, sociology, linguistics, discourse analysis, sociolinguistics, as well as citizen science. On the other hand, the transcripts are very easy to obtain directly from the internet, and have, unlike most other corpora, no copyright, privacy protection or terms-of-use barriers to their collection, processing and dissemination. It is therefore not surprising that many corpora of parliamentary proceedings have already been compiled (Fišer & Lenardič 2018; Lenardič & Fišer 2023), and there are numerous studies of parliamentary speeches that explored various themes, e.g. a study on populism and the strategies employed by the MPs in representing and involving people in parliamentary discourse (Truan 2019), a discourse analysis providing insights into the treatment of female politicians (Stopfner 2018) or a study on representation of what is deemed "uncivilised" (people, places and practises) across the past two centuries (Alexander & Struan 2022).

However, as a rule, the existing corpora cover a single parliament, with, so far, almost no attempts (but see (Truan and Romary, 2022) and (Sylvester, Greene, and Ebing, 2022) for two exceptions) to develop a large and comparable set of corpora of national parliamentary proceedings.

The ParlaMint I project (2020–2021) produced a set of comparable parliamentary corpora of 17 European national parliaments with almost half a billion words, mostly starting in or before 2015 and ending in mid-2020, with the corpora uniformly encoded and containing rich metadata about the 11 thousand speakers. In addition to this "plain text" set of corpora, a linguistically annotated version was also released and both were made openly available for download and analysis through concordancers (Erjavec, Ogrodniczuk, et al. 2023).

This paper presents the results of the continuation of the project, ParlaMint II (2022–2023), which enlarged the set of corpora to 29 European countries and autonomous regions (c.f. Fig. 1), extended the time coverage to at least 2022, and introduced other enhancements. In the scope of ParlaMint II, three versions of the corpora were published: 3.0, an intermediate project release, 4.0, the final project release and 4.1 as a maintenance release completed after the project's end, which corrects some errors found in 4.0 and extends the time-frame of the PT and UA corpora. In this paper, we present version 4.1, which comprises the "plain text" corpora (Erjavec, Kopp, Ogrodniczuk, Osenova, Agirrezabal, et al. 2024), the linguistically annotated corpora (Erjavec, Kopp, Ogrodniczuk, Osenova, Agerri, et al. 2024), and the corpora machine-translated to English (Kuzman et al. 2024).

The paper focuses on the enhancement introduced in ParlaMint II and is structured as follows: Sect. 2 describes the compilation of the corpora, including the encoding, use of GitHub, a short per-corpus overview, the common pipeline for finalising the corpora, and the use of CLARIN services for dissemination; Sect. 3

gives a quantitative overview of the produced corpora, i.e. basic statistics of the corpora, of the speakers and their affiliations, and of the speeches; Sect. 4 discusses the qualitative additions made within the ParlaMint II project, namely the metadata localisation, the addition of new metadata, the machine translation of the corpora to English and its semantic tagging, and the production of pilot speech corpora; and Sect. 5 gives the conclusions, including outreach activities and a discussion of plans for further work.

## 2 Corpus compilation

Both in ParlaMint I and ParlaMint II, the individual partners were responsible for producing ParlaMint-compatible corpora of their parliament rather than these being centrally gathered and compiled. It was therefore important to ensure good annotation guidelines, a robust and versatile collaborative environment and validation procedures, to prevent errors and facilitate interoperability of the released set of corpora. In this section, we overview these aspects of the project, as well as giving a short overview of the related work on the individual ParlaMint corpora. Furthermore, we also explain the workflow for finalising the corpora, and their distribution via the CLARIN infrastructure.

### 2.1 The ParlaMint encoding

The XML schema used for validation and schema-aware editing of ParlaMint I corpora was based on the Parla-CLARIN recommendations[1] (Erjavec & Pančur 2022), a customisation of the Text Encoding Initiative (TEI) Guidelines[2] (TEI Consortium 2017). The main reasons that TEI was taken as the basis for the encoding were that it is already used by the majority of existing parliamentary corpora, is broad enough to cover all aspects of our mark-up, and provides a good infrastructure in terms of customisation, validation, and documentation.

It should be noted that the ParlaMint I schema was written directly in the XML validation language RelaxNG, rather than being defined by a TEI ODD document, which customises TEI for a particular project or purpose, and which is the mandated way of constructing a TEI schema. An ODD (One Document Does it all) should also contain the prose annotation guidelines, while the element and attribute specifications are accompanied by explanatory prose and examples.

In ParlaMint II, we first revised the Parla-CLARIN recommendations to take into account lessons learned in the ParlaMint I project, while still maintaining their broad applicability. Next, we wrote the ParlaMint ODD, based on the Parla-CLARIN one, which further constrains the schema specification and gives detailed ParlaMint-related prose guidelines. In the schema specification, we also substituted many generic TEI descriptions of elements and examples of their use with

[1] https://github.com/clarin-eric/parla-clarin/.

[2] https://tei-c.org/.

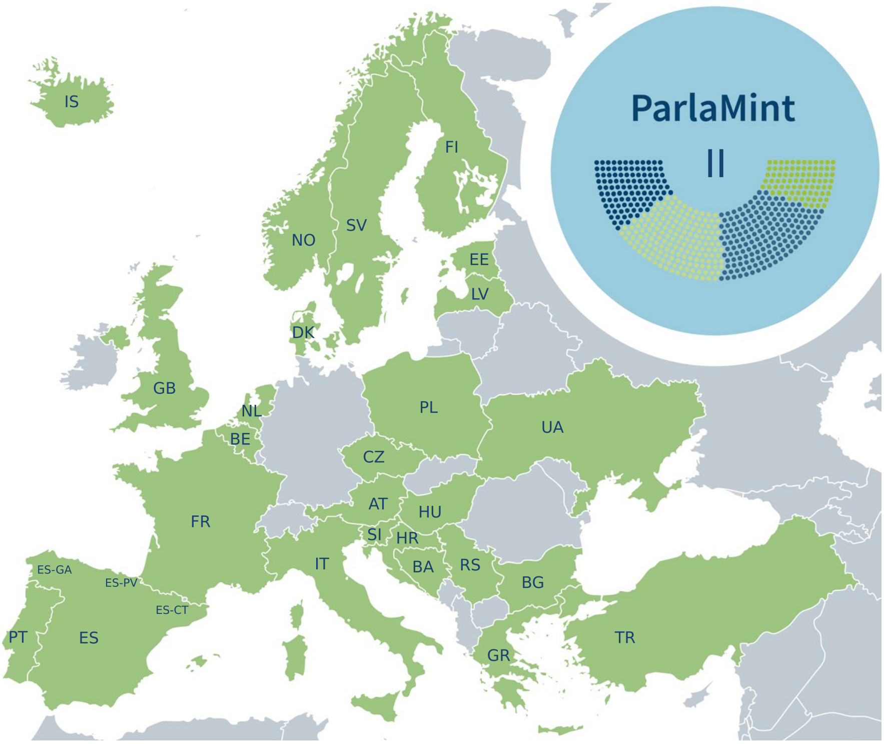

**Fig. 1** Coverage of ParlaMint corpora. The codes for countries and autonomous regions follow ISO 3166 “Codes for the representation of names of countries and their subdivisions” and are used in the rest of the paper

ParlaMint-specific explanations and snippets from the actual corpora. The ParlaMint (and, where relevant, Parla-CLARIN) recommendations were also extended with the new types of annotations introduced in ParlaMint II (cf. Sect. 4).

As with Parla-CLARIN, the ParlaMint TEI ODD schema is compiled into a RelaxNG schema for XML validation or other processing, such as XML schema-aware editing, while the guidelines, as well as the schema specification are compiled into HTML for reading. For validation, we are currently still also using (and updating) the ParlaMint I type RelaxNG schemas, mostly as they have the advantage for quick tests of schema changes, and more fine-grained control over content models. This means a certain amount of overhead, as each stable change has to be implemented and each document validated twice, however, it offers greater flexibility in developing and using the ParlaMint schemas.

ParlaMint I also established precise rules for the naming and structure of files and directories of a corpus, and these have not changed in ParlaMint II. However, there was one change that impacted the number of files. In ParlaMint I, a corpus root file contained the complete corpus TEI header (and XIncludes of the corpus components, i.e. transcriptions), which includes taxonomies (controlled vocabularies), and the list of speakers and of organisations. The latter two made the central file of a corpus very large, and so unwieldy (in editors) or impossible (in GitHub) to display, complicating its maintenance. Furthermore, ParlaMint II made a concerted effort to unify and localise (translate) its taxonomies into the ParlaMint II languages (cf. Sect. 4) and having taxonomies as part of each root file also complicated this development.

For these reasons, we factored out the files for the speakers, organisations, and the eight ParlaMint II taxonomies, with the files XIncluded in the TEI header of the corpus root file. Note that specifics of particular parliaments could still be expressed in local taxonomies, in which case the corpus includes two types of taxonomies for the relevant metadata dimension: the common and the corpus-specific one.

In ParlaMint I, there were taxonomies for legislature, speaker types, and subcorpora, and in the linguistically analysed version, also for Universal Dependencies (UD) (de Marneffe et al. 2021) syntactic labels and the standard 4-class named entities (Tjong Kim Sang and De Meulder 2003).

In ParlaMint II, we unified the UD labels by automatically deriving the taxonomy (i.e. the list) of labels with their glosses from the UD GitHub repository.[3] We also added two taxonomies for political orientation, and one for USAS semantic classes (cf. Sect. 4).

## 2.2 Use of GitHub

GitHub was already used in ParlaMint I, where it not only supported revision control of all ParlaMint schemas and tools[4] but was also central to setting up the corpus compilation workflow. In ParlaMint II, due to the much larger number of partners, all detailed technical discussions were moved to GitHub issues,[5] while the aforementioned ParlaMint encoding guidelines were made available on the GitHub pages.[6] This step also had a significant impact on the corpora already included in the ParlaMint I project, as not only were they expanded in ParlaMint II, but more rigorous validation procedures (including manual corpus verification by the corpus editors) were applied, discovering various errors or potential changes needed to make the corpora even more consistent and interoperable. A number of such issues are still open, but they represent valuable (and public) documentation about the problems that have already been discovered.

The workflow for producing the individual corpora is based on the idea that a contributor of a corpus forks the main ParlaMint repository on GitHub, inserts a sample of their ParlaMint corpus to the fork, and then makes a pull request once the sample is compatible with ParlaMint. Ideally, this involves using the supplied and self-documenting `Makefile` to validate their sample and down-convert it to other formats,[7] with the partner then checking them for errors. Even if local validation is not possible

[3] https://github.com/UniversalDependencies/docs/tree/0749864b5048bb8995fe68aedc37f721bc1338ee.

[4] ParlaMint toolbox is written in XSLT and Perl, and the whole environment depends only on software found on Linux systems, as well as some easily obtainable support tools.

[5] To date, over 450 issues have been posted, many with detailed discussions.

[6] https://clarin-eric.github.io/ParlaMint/.

[7] The down-conversion itself also uncovers errors, as scripts may issue error messages or fail to complete, and the generated CoNLL-U files are validated with the official Universal Dependencies validator.

(e.g. due to lack of access or lack of familiarity with Linux), a pull request to the repository triggers validation and down-conversion using GitHub Actions.

Following the partner's submission of a pull request and successful or almost successful automatic validation, a corpus editor verifies the sample. Subsequently, an issue containing a list of identified errors or suggested improvements for the sample is created. This issue is then used to discuss specific problems related to the sample. Once the issues are resolved, the sample is merged into the main repository in all formats. The sample can then be cited and commented on in issues, used in the documentation, or used directly as an example for other compilers of a ParlaMint corpus. Once valid samples are available, the partners would move on to producing the complete corpus, which would be collected and processed centrally (including validation, cf. Section 2.4) to make a distribution.[8]

In practice, this workflow, together with on-going revisions of the encoding, was somewhat complicated to implement, mainly because the structuring of the samples was somewhat different from that of the complete corpora.[9] Nonetheless, despite the complications, Git and GitHub were generally accepted by the ParlaMint partners. Erjavec, Kopp, & Meden (2024) present a survey among the partners about their experiences with Git(Hub). The survey collected 35 responses and the answers show a generally positive experience with the communication and workflow throughout the process, although not everyone was very happy with the use of GitHub issues and most complained about the differences between the production of the samples and the complete corpora. The group of (digital) humanities participants, as expected, generally had more difficulties with Git(Hub) and the workflow compared to the group of non-DH participants, which consisted mainly of computer scientists and/or computational linguists. However, both groups agreed that they are very likely to use Git in their future work.

### 2.3 Compiling individual corpora

As mentioned, the partners produced their ParlaMint-encoded corpora individually, as well as performed their linguistic analysis and mark-up. For ParlaMint I, the corpus compilation of the individual corpora was described in Erjavec, Ogrodniczuk, et al. (2023), while the number of partners precludes such a comprehensive description for ParlaMint II. However, this information is, in ParlaMint II, readily available in the `README` files for each corpus in the `ParlaMint/Samples/` directory on GitHub.[10] Nevertheless, to present the related work on the individual corpora, we here give, first, a list of those corpora that have publications on how they were compiled, and, second, a Table enumerating the tools that were used for the linguistic annotation.

The following corpora have published papers on their compilation:

[8] While it would be ideal to store complete corpora in Git, the number and total size of files make this difficult.

[9] This has been now simplified, partly due to the common pipeline discussed in Sect. 2.4.

[10] https://github.com/clarin-eric/ParlaMint/tree/main/Samples.

AT: The ParlaMint corpus is based on the ParlAT Corpus (Wissik and Pirker 2018), which had a slightly different encoding (Wissik 2022) from the ParlaMint one.
CZ: The source for the ParlaMint corpus was the Czech parliamentary corpus ParCzech 4.0 (Kopp 2024b), which has slightly extended the ParlaMint schema in order to have more detailed named entities and audio alignment. The development process of a previous version of this corpus is described in Hladká, Kopp, and Straňák (2020); Kopp, Stankov, Krůza, Straňák, and Bojar (2021).
IS: The compilation of a previous version of the corpus is described in Steingrímsson, Barkarson, and Örnólfsson, (2020).
IT: A detailed description of a previous version of the corpus is given in Agnoloni et al. (2022).
SI: The source for the ParlaMint corpus was siParl 3.0[11] (Pančur et al. 2022), with a previous version of siParl described in Pančur and Erjavec (2020).
UA: The corpus corpus compilation method is described in Kryvenko and Kopp (2023).

Once the plain-text version of each corpus was ready, it had to be linguistically annotated. It was up to the partners which tools to use for this task, and Table 1 presents their overview.

It can be seen that numerous tools were used for linguistic annotation, however, with certain (multilingual) tools being employed for a number of corpora. In particular, UDPipe was used for eight corpora, CLASSLA-Stanza for five, Stanza for four, and NameTag also for four corpora.

In addition to the linguistic analysis as such, each partner also had to convert their ParlaMint-encoded corpus into the format that could serve as the input to the linguistic annotation tool, and then insert the linguistic annotations into their corpus. Here, the biggest challenge turned out to be dealing with the transcribers' comments which were located directly inside paragraphs, i.e. mixed with the annotated text. Some XML tools for this merging, in particular those in the pipeline used to make the ParCzech corpus (Kopp 2022) and that used for BA, HR, SR, and SI corpora were used in the context of cross-team assistance for other corpora as well.

### 2.4 The pipeline for corpus distribution

While each partner produced their ParlaMint corpus, there was nevertheless some central processing to compile the corpora to the datasets that form a part of a distribution.

First, the newly localised metadata and the added TSV-formatted metadata (cf. Sect. 4) were added to the corpora. Second, there were certain details that were observed to be wrong in the submitted corpora, and while each partner was notified

[11] The latest version of the corpus, siParl4.0, is available via the CLARIN.SI repository (Pančur et al. 2024) and is described in Meden, Erjavec, and Pančur (2024).

**Table 1** Overview of tools used to linguistically annotate the individual ParlaMint corpora for their four annotation layers: segmentation into tokens and sentences ⊙, morphological analysis and lemmatisation ●, syntactic analysis ◬, and Named Entity Recognition ○

| ID | Linguistic annotation |
|---|---|
| AT | ◉ UDPipe (Straka, 2018), ○ NameTag (Straková, Straka, & Hajič, 2019) |
| BA | ⊛ CLASSLA-Stanza (Ljubešić & Dobrovoljc, 2019; Terčon & Ljubešić, 2023) |
| BE | ⦿ int-tagger, ◬ UDify (Kondratyuk & Straka, 2019), ○ flair-ner (Akbik et al., 2019) |
| BG | ⊛ CLASSLA-Stanza (Ljubešić & Dobrovoljc, 2019; Terčon & Ljubešić, 2023) |
| CZ | ◉ UDPipe (Straka, 2018), ○ NameTag (Straková et al., 2019) |
| DK | ● cstlemma (Jongejan & Dalianis, 2009), ◉ UDPipe (Straka, 2018), ○ CST-NER |
| EE | ⊚ EstNLTK (Laur, Orasmaa, Särg, & Tammo, 2020), ◮ Stanza (Qi, Zhang, Zhang, Bolton, & Manning, 2020) |
| ES-CT | ◍ Freeling, ◬ UDPipe (Straka, 2018) |
| ES-GA | ⦿ Freeling, ◬ UDPipe (Straka, 2018), ○ NER |
| ES-PV | ◉ UDPipe (Straka, 2018), ○ XLM-RoBERTa |
| ES | ◉ UDPipe (Straka, 2018), ○ NameTag (Straková et al., 2019) |
| FI | ◉ NLP-pipeline (Tamper, Leskinen, Apajalahti, & Hyvönen, 2018), ○ Nelli-Tagger (Tamper, Oksanen, Tuominen, Hietanen, & Hyvönen, 2020) |
| FR | ⊛ Stanza (Qi et al., 2020) |
| GB | ⊛ stanford-corenlp (Manning et al., 2014) |
| GR | ⊛ ILSP Neural NLP Toolkit for Greek (Prokopidis & Piperidis, 2020) |
| HR | ⊛ CLASSLA-Stanza (Ljubešić & Dobrovoljc, 2019; Terčon & Ljubešić, 2023) |
| HU | ⊛ huspacy (Orosz, Szántó, Berkecz, Szabó, & Farkas, 2022) |
| IS | ⊙ tokenizer, ● abltagger-pos, ● nefnir, ○ IcelandicNER (Guðjónsson, Loftsson, & Daðason, 2021), ◮ combo-ud (Jasonarson, Steingrímsson, Sigurðsson, & Daðason, 2022) |
| IT | ⊛ Stanza (Qi et al., 2020) |
| LV | ⊛ LV-NLP-PIPE (Znotins & Cirule, 2018) |
| NL | ⦿ int-tagger, ◬ udify (Kondratyuk & Straka, 2019), ○ flair-ner (Akbik et al., 2019) |
| NO | ⊛ Spacy (Honnibal, Montani, Van Landeghem, & Boyd, 2020) |
| PL | ● app-morfeusz, ● app-concraft, ○ app-liner, ◮ app-combo |
| PT | ⊙ LX-tokenizer (Branco & Silva, 2004), ◙ MBT-tagger, ◬ LX-UD (Branco, Silva, Gomes, & António Rodrigues, 2022) |
| RS | ⊛ CLASSLA-Stanza (Ljubešić & Dobrovoljc, 2019; Terčon & Ljubešić, 2023) |
| SE | ⊛ Stanza (Qi et al., 2020) |
| SI | ⊛ CLASSLA-Stanza (Ljubešić & Dobrovoljc, 2019; Terčon & Ljubešić, 2023) |
| TR | ⦿ TRmorph (Çöltekin, 2010), ◬ steps-parser (Grünewald, Friedrich, & Kuhn, 2021), ○ TurkishNER |
| UA | ◉ UDPipe (Straka, 2018), ○ NameTag (Straková et al., 2019) |

of the problems, not everybody was able to correct them (e.g. because the person who produced the corpus was no longer available), so a script was written that corrected those errors that could be fixed automatically (while the others were reported in GitHub issues). Third, the TEI header of each corpus contains a fair amount of redundant (as it can be computed) metadata on the corpora, such as extents, quantitative information about the usage of tags, boilerplate titles, the version of the corpus etc., and the third script adds this metadata to the corpora in case it had not been inserted already or was wrong. The ParlaMint-wide taxonomies are also reduced to English and the language of the corpus and stored together with the corpus. With these three processing steps, the final ParlaMint-encoded corpora for a particular release have been compiled.

The next stage involves producing the corpora as they are present in the distribution. Extensive validation is performed first, not only via the ParlaMint RelaxNG and ODD schemas, but also checking the validity of all links, and, with a dedicated

XSLT script, validating content, something that cannot be performed with XML schemas. The script produces extensive log files with informative, warning, and error messages. After validation, down-conversions are performed, which transform the corpus into simpler and directly usable formats, i.e. plain text, CoNLL-U files, per-speech TSV metadata files, as well as vertical files for the concordancers. The last operation is packaging the corpora in all the formats (and adding `README`s) as `.tgz` files for uploading to the repository.

### 2.5 Use of CLARIN services

As with ParlaMint I, the complete corpora are available for open (CC BY) download from the CLARIN.SI repository of language resources and tools.[12] In addition to the corpora, each repository entry also contains the log files produced by the corpus compilation pipeline, as well as the GitHub files corresponding to the release.

The corpora are also available for on-line exploration. As in ParlaMint I, they are mounted on the CLARIN.SI concordancers, in particular the noSketch Engine[13] (Kilgarriff et al. 2014) and KonText[14] (Machálek 2020).

A new addition in ParlaMint II is the integration of corpora into the TEITOK web-based corpus platform[15] (Janssen 2016; Janssen & Kopp 2024). This platform not only enables users to query the corpus but also broadens access to parliamentary data for a diverse audience through the incorporation of a browsing feature. This feature facilitates the reading of transcripts and allows users to seamlessly switch between multiple view modes, enabling them to select the mode that best aligns with the specific demands of their research domain. Additionally, user can also explore persons, organisations and their relations.

## 3 Overview of the corpora

This section gives quantitative information about the current version of the ParlaMint corpora, in particular some basic statistics in terms of the languages used, their time span and size, statistics over the main metadata about the speakers, and over the speeches, i.e. transcriptions.

### 3.1 Basic statistics

ParlaMint version 4.1 comprises 29 corpora with 30 main languages[16] containing 8 million speeches and 1.2 billion words. Table 2 gives a quantitative overview of some basic characteristics of the individual corpora.

[12] https://www.clarin.si/repository/xmlui.

[13] Without log-in (https://www.clarin.si/ske) and with log-in (https://www.clarin.si/skelog), which provides more functions.

[14] https://www.clarin.si/kontext.

[15] https://lindat.mff.cuni.cz/services/teitok/parlamint-41/.

[16] Or 29, if the NO language varieties Bokmål and Nynorsk are taken as one language, i.e. Norwegian.

**Table 2** Basic information about the ParlaMint corpora including the corpus country or region code (ID), the language(s) of the corpus (Lang), the parliamentary bodies included (Bodies = uni / unicameral parliament, upp / upper house, low / lower house, com / parliamentary committees), the number of terms included in the corpus (Ts), start (From) and end (To) month of included transcripts, the number of years covered (Yr), the number of millions of words per year (Mw/Yr) and in total (Mw)

| ID | Lang | Bodies | Ts | From | To | Yrs | Mw/Yr | Mw |
|---|---|---|---|---|---|---|---|---|
| AT | de | low | 8 | 1996-01 | 2022-10 | 27.1 | 2.24 | 60.84 |
| BA | bs | uni | 7 | 1998-11 | 2022-07 | 24.0 | 0.76 | 18.31 |
| BE | fr+nl | low+com | 2 | 2014-06 | 2022-07 | 8.2 | 5.42 | 44.37 |
| BG | bg | uni | 5 | 2014-10 | 2022-07 | 7.9 | 3.37 | 26.47 |
| CZ | cs | low | 3 | 2013-11 | 2023-07 | 9.8 | 3.14 | 30.77 |
| DK | da | uni | 4 | 2014-10 | 2022-06 | 7.8 | 5.25 | 40.80 |
| EE | et | uni | 3 | 2011-04 | 2022-06 | 11.4 | 2.01 | 22.87 |
| ES-CT | es+ca | uni | 4 | 2015-10 | 2022-07 | 6.8 | 2.33 | 15.95 |
| ES-GA | gl | uni | 3 | 2015-01 | 2022-05 | 7.4 | 2.40 | 17.84 |
| ES-PV | eu+es | uni | 3 | 2015-02 | 2022-07 | 7.5 | 1.80 | 13.54 |
| ES | es | low | 5 | 2015-01 | 2023-02 | 8.2 | 2.39 | 19.65 |
| FI | fi+sv | uni | 2 | 2015-04 | 2022-01 | 6.9 | 1.98 | 13.54 |
| FR | fr | low | 2 | 2017-06 | 2022-03 | 4.8 | 10.33 | 49.63 |
| GB | en | low+upp | 4 | 2015-01 | 2022-07 | 7.6 | 16.56 | 126.71 |
| GR | el | uni | 3 | 2015-01 | 2022-02 | 7.2 | 6.91 | 49.70 |
| HR | hr | uni | 5 | 2003-12 | 2022-07 | 18.8 | 4.64 | 87.32 |
| HU | hu | uni | 3 | 2014-05 | 2023-07 | 9.4 | 3.29 | 30.85 |
| IS | is | uni | 4 | 2015-01 | 2022-07 | 7.6 | 4.10 | 31.19 |
| IT | it | upp | 2 | 2013-03 | 2022-09 | 9.7 | 3.31 | 31.97 |
| LV | lv | uni | 2 | 2014-11 | 2022-10 | 8.1 | 1.13 | 9.16 |
| NL | nl | low+upp | 5 | 2014-04 | 2022-09 | 8.5 | 7.86 | 66.85 |
| NO | nb+nn | uni+low+upp | 7 | 1998-10 | 2022-09 | 24.3 | 3.63 | 88.45 |
| PL | pl | low+upp | 4 | 2015-11 | 2022-06 | 6.7 | 5.35 | 36.06 |
| PT | pt | uni | 4 | 2015-01 | 2024-03 | 9.4 | 2.51 | 23.49 |
| RS | sr | uni | 9 | 1997-12 | 2022-07 | 25.0 | 3.38 | 84.57 |
| SE | sv | uni | 2 | 2015-09 | 2022-05 | 6.8 | 4.28 | 28.98 |
| SI | sl | low | 6 | 2000-10 | 2022-05 | 21.9 | 3.20 | 69.92 |
| TR | tr | uni | 4 | 2011-06 | 2022-11 | 11.6 | 4.26 | 49.26 |
| UA | uk+ru | uni | 6 | 2002-05 | 2023-11 | 21.8 | 1.93 | 42.00 |

The first column gives the country codes of the corpora, and the second column the ISO 639 Set 1 code of the main language(s) used in the corpus. Language is identified on the paragraph (technically, the <seg> element) level which appears inside speeches, as some speakers switch between languages.[17] Out of the 29

[17] UA additionally identifies the language on the sentence level. The paragraph language is set to the language that has more tokens in paragraph.

corpora, 6 are bilingual, and the table gives the predominant language first. It should be noted that some corpora mark snippets (individual speeches or paragraphs) in other languages, in particular English and French.

The third column contains labels for parliamentary bodies included in the transcripts: unicameral parliament, lower and/or upper house for bicameral parliaments, and parliamentary committees. This is important information for the comparability of the corpora, as it is sensible to compare the speeches of the same type of body, although most likely treating unicameral parliaments and lower house as the same type. Most corpora are either unicameral or contain lower house transcriptions only, while Great Britain, Netherlands, and Poland contain transcripts of both the upper and lower house. The Norwegian corpus contains labels for both unicameral, as well as for lower and upper houses because in 2009 Norway changed its parliamentary system from a (pseudo-) bicameral to a unicameral one. The only corpus containing only the transcripts of the upper house is the Italian one. The Belgian corpus is currently the only one in ParlaMint that also includes the sessions of various parliamentary committees.

The next three columns give time-related information on the corpora, starting with the number of (possibly partial) terms[18] that the corpus covers. These largely reflect the time-frame of the corpus, but also indicate the dynamics of (possibly extraordinary) elections. The From and To dates and, hence, the number of years of included speeches vary considerably, with almost all starting in or before 2015 and ending in 2022. The only corpus that starts after 2015 is the French one (starting mid 2017, and, as the shortest corpus, containing less than 5 years, ending in 2022), while many others start much sooner, with the Austrian one going as far back as 1996, and covering, as the longest corpus, over 27 years. As for the end dates, the Finish corpus ends in January 2022, while, on the other hand, the Ukrainian one extends to November 2023, and the Portuguese one all the way to March 2024.

Finally, the last two columns give the size of each corpus in words per year and as a whole. By far the largest corpus, both per year and in total, is that of Great Britain (16 and 126 million), with even the fact that it contains the speeches of both the House of Lords and of the House of Commons not fully explaining its size, which must be a result of longer or more sessions of their parliaments. In the opposite direction, the outliers are the Bosnian corpus (only.76 million words per year) and the Latvian corpus (only 9 million words in total). The former has relatively few sessions, while the latter covers less years than the others, except for France.

### 3.2 Metadata on speakers

The ParlaMint corpora contain significant metadata about its 24,134 speakers, which allows for various political or sociological but also linguistic studies for which speaker-related variables are required. Table 3 gives an overview of speaker-related data over the individual corpora.

[18] The number of terms (elections) refers to those of the lower house, if it is present in the corpus, of the upper house for the rest.

**Table 3** Metadata on speakers divided into three groups

| | Organisation | | | Person | | | | Affiliation | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ID | Org | Prt | C/O | Pers | Sex | Birth | URL | Affil | Mini | MPs | PrtyM |
| AT | 37 | 18 | 38 | 854 | 854 | 848 | 854 | 3,381 | 122 | 776 | 795 |
| BA | 42 | 40 | 14 | 603 | 282 | 231 | 0 | 848 | 24 | 282 | 278 |
| BE | 68 | 66 | 19 | 786 | 569 | 569 | 0 | 2,174 | 35 | 551 | 551 |
| BG | 46 | 38 | 6 | 1,032 | 1,032 | 912 | 99 | 4,309 | 25 | 838 | 817 |
| CZ | 450 | 33 | 7 | 597 | 570 | 507 | 572 | 13,632 | 93 | 536 | 465 |
| DK | 21 | 19 | 8 | 383 | 383 | 383 | 0 | 1,025 | 73 | 383 | 383 |
| EE | 8 | 6 | 7 | 488 | 264 | 263 | 0 | 1,140 | 62 | 263 | 262 |
| ES-CT | 39 | 37 | 5 | 364 | 364 | 364 | 0 | 1,726 | 44 | 324 | 364 |
| ES-GA | 59 | 57 | 6 | 227 | 227 | 214 | 182 | 712 | 16 | 170 | 212 |
| ES-PV | 11 | 9 | 5 | 197 | 197 | 175 | 156 | 442 | 21 | 193 | 193 |
| ES | 52 | 50 | 10 | 941 | 926 | 884 | 0 | 1,849 | 65 | 843 | 826 |
| FI | 19 | 17 | 16 | 314 | 310 | 310 | 0 | 1,187 | 77 | 306 | 305 |
| FR | 185 | 26 | 5 | 908 | 908 | 902 | 0 | 2,621 | 18 | 846 | 814 |
| GB | 37 | 34 | 5 | 1,951 | 1,951 | 0 | 1,951 | 8,995 | 0 | 1,868 | 1,947 |
| GR | 16 | 14 | 5 | 635 | 635 | 0 | 0 | 2,562 | 91 | 532 | 532 |
| HR | 47 | 45 | 12 | 1,036 | 660 | 660 | 0 | 2,456 | 78 | 660 | 660 |
| HU | 94 | 38 | 6 | 492 | 492 | 488 | 0 | 3,411 | 25 | 279 | 343 |
| IS | 12 | 9 | 5 | 261 | 261 | 261 | 261 | 925 | 26 | 138 | 239 |
| IT | 47 | 45 | 23 | 771 | 771 | 771 | 771 | 3,164 | 82 | 706 | 597 |
| LV | 13 | 11 | 6 | 234 | 234 | 0 | 0 | 488 | 35 | 196 | 196 |
| NL | 50 | 35 | 14 | 586 | 586 | 542 | 557 | 1,140 | 49 | 244 | 549 |
| NO | 17 | 13 | 9 | 1,106 | 1,106 | 1,106 | 0 | 5,067 | 141 | 1,069 | 1,106 |
| PL | 12 | 9 | 4 | 1,223 | 1,223 | 753 | 753 | 2,161 | 53 | 753 | 645 |
| PT | 25 | 22 | 12 | 836 | 836 | 761 | 0 | 3,143 | 64 | 696 | 816 |
| RS | 73 | 71 | 18 | 1,724 | 1,472 | 1,472 | 0 | 4,934 | 57 | 1,472 | 1,472 |
| SE | 15 | 13 | 5 | 649 | 649 | 0 | 0 | 1,688 | 49 | 626 | 644 |
| SI | 32 | 29 | 30 | 973 | 973 | 466 | 330 | 1,645 | 59 | 415 | 410 |
| TR | 83 | 47 | 3 | 1,346 | 1,234 | 1,234 | 1,204 | 7,326 | 96 | 1,218 | 1,229 |
| UA | 151 | 148 | 38 | 2,617 | 2,617 | 2,459 | 528 | 10,661 | 225 | 1,827 | 1,826 |

The first relates to (political) organisations, the second to persons, and the third to their affiliations to organisations. The first group consists of the number of defined organisations (Org), political parties and parliamentary groups (Prt), coalitions and oppositions (C/O); the second of the number of defined persons (Pers), with known sex (Sex), birth date (Birth), and with Web link(s) (URL). The third group gives the number of defined affiliations (Affil), the number of ministers (Mini), members of parliament (MPs), and members of political parties or parliamentary groups (PrtyM)

The first group of the three columns relates to organisations. In the corpora, each organisation is given an ID, its full and abbreviated name, and, depending on the corpus, also the dates of its existence. The first numerical column gives the number of such entities, followed by political parties[19] only. It should be noted that corpora differ in terms of which organisations (as well as affiliations, i.e. the last group in the table) they encode: some encode only those that fall into the time-frame of their corpus, while others give the complete history of the persons and hence their organisations. The last column in this group gives the number of time-stamped coalitions and (for some corpora) oppositions of parliamentary groups (C/O).

The second group of four columns gives the numbers related to the defined persons. The low numbers typically belong to regional parliaments (e.g. Basque country) or countries with a small population (Iceland), but are also dependent on the time span of the corpus, as a larger time-span will involve more speakers. The next three columns give the number of persons with additional personal details. The first is if they have a specified sex (useful for gender studies). All corpora have this information, if not for all speakers, then at least for the MPs. The next column gives the date of birth (for age-correlated studies), which is present in 25 corpora, and the last one states how many persons are associated with one or more URLs (Wikipedia page, official government Web page, Twitter or Facebook account), which could be of use for discovering more information about speakers, as well as for named entity linking; however, this information is available for only 12 corpora, and, except for AT, GB, and IT, for only an (often small) subset of the speakers.

The last group of four columns quantify the numbers related to affiliations of persons with organisations. The first column gives the number of affiliations that persons have, together almost 95 thousand affiliations or, on average, 3.9 affiliations per person. The minimum here is BA with 1.4 affiliations per person, while the maximum is CZ with 22.8, as it gives the complete affiliation history of a person; without CZ the average is 3.4. The affiliations also specify the role of the person in the organisation, as well as (for most corpora) the dates of the affiliation. The last three columns give the numbers of persons with particularly important affiliations: the first is the number of ministers, the second the number of MPs, and the third the number of people who are members of political parties or parliamentary groups.

### 3.3 Speeches and associated mark-up

The ParlaMint corpora contain over 8 million speeches and 8.4 million elements with related information. The former is given in the first, and the latter in the second block of columns in Table 4.

The first group starts with the number of speeches per corpus, with the minimum for Basque country (40,000) and with, surprisingly, given its small date range, France having the most (over 700,000), meaning that their speeches are much shorter, most likely more dialogues, rather than monologues. The next column gives the number of speeches that are marked with their speaker, which is important for investigations that take into account the characteristics of the speakers. All the corpora give the speaker for the vast majority of the speeches,

[19] In the corpora, we distinguish political parties from parliamentary groups, i.e. groups of parties forming a common list in the parliament. In Table 3, we count both as “Parties”.

**Table 4** Overview of the speeches in the corpora

| | Speeches | | | Other mark-up | | | |
|---|---|---|---|---|---|---|---|
| ID | Speeches | W.Spks | W.NCs | Heads | Notes | Incidents | Gaps |
| AT | 231,759 | 231,759 | 106,717 | 0 | 680,688 | 337,759 | 15,162 |
| BA | 126,252 | 126,030 | 67,754 | 0 | 126,326 | 3,483 | 3,679 |
| BE | 199,305 | 198,684 | 156,960 | 0 | 508,639 | 992 | 4,535 |
| BG | 210,018 | 208,565 | 107,315 | 0 | 0 | 51,652 | 0 |
| CZ | 196,185 | 196,185 | 91,320 | 0 | 243,108 | 33,355 | 1,086 |
| DK | 398,610 | 398,610 | 398,610 | 14,302 | 14,302 | 0 | 0 |
| EE | 227,872 | 227,872 | 130,934 | 0 | 233,814 | 0 | 0 |
| ES-CT | 50,824 | 50,824 | 27,031 | 283 | 67,172 | 21,099 | 127 |
| ES-GA | 83,078 | 83,078 | 38,090 | 0 | 91,441 | 58,417 | 0 |
| ES-PV | 39,148 | 39,148 | 18,014 | 0 | 47,882 | 0 | 0 |
| ES | 76,369 | 43,886 | 32,739 | 2,640 | 5,886 | 71,182 | 694 |
| FI | 146,858 | 146,858 | 116,755 | 6,806 | 10,635 | 42,150 | 0 |
| FR | 714,860 | 697,095 | 621,806 | 22,123 | 22,126 | 91,128 | 0 |
| GB | 670,912 | 667,916 | 654,567 | 31,215 | 191,793 | 0 | 0 |
| GR | 342,274 | 342,274 | 220,760 | 7,578 | 365,334 | 54,775 | 1,263 |
| HR | 504,338 | 497,137 | 257,753 | 0 | 498,874 | 29,145 | 51,084 |
| HU | 116,346 | 116,325 | 57,726 | 0 | 154,671 | 99,632 | 37 |
| IS | 95,286 | 95,286 | 92,578 | 0 | 137 | 49,810 | 0 |
| IT | 172,796 | 172,796 | 93,162 | 13,170 | 193,510 | 74,054 | 0 |
| LV | 162,782 | 162,782 | 80,747 | 0 | 163,720 | 0 | 0 |
| NL | 609,248 | 609,248 | 445,589 | 6,100 | 783,558 | 0 | 0 |
| NO | 398,809 | 396,858 | 275,017 | 20,123 | 1,565,683 | 0 | 0 |
| PL | 228,326 | 228,326 | 122,443 | 686 | 241,406 | 248,396 | 1,606 |
| PT | 248,577 | 248,577 | 179,715 | 1,832 | 43,547 | 92,459 | 0 |
| RS | 316,069 | 315,896 | 156,156 | 0 | 318,697 | 4,203 | 1,786 |
| SE | 84,662 | 83,436 | 84,662 | 15,819 | 370,551 | 9,656 | 0 |
| SI | 311,354 | 311,354 | 153,770 | 4,706 | 392,734 | 3,668 | 38,654 |
| TR | 681,052 | 681,052 | 486,410 | 0 | 109,555 | 114,378 | 0 |
| UA | 429,437 | 429,417 | 221,701 | 0 | 730,120 | 22,819 | 1,157 |

The first group gives the number of speeches (Speeches), how many speeches have a defined speaker (W.Spks), and how many are not spoken by the chair of the sessions (W.NCs). The second block gives other markup related to the speeches, i.e. the number of marked-up headings (Heads), notes (Notes), vocal, kinesic and other incidents (Incidents), and missing pieces of the transcriptions (Gaps)

with the least by Sweden but even here less than 1.5% are missing. The next column shows the numbers of speeches spoken by non-chairs of the session (MPs, government members or guests), potentially an important piece of data, as chairs speak a lot but mostly on procedural matters, so studies will likely filter out the speeches by chairs. For most corpora, the chairs give around half of all the speeches, with two exceptions. The SE corpus does not mark the role of the speaker, which is why the number of all speeches in the table equal to the number of the speeches by non-chairs, while IS has only about 7% of speeches given by chairs; this is a result of the source data on their parliamentary web site, which provides speeches by chairs only for their introductory speeches, but not the short speeches in the middle of the sessions, where they are mostly just giving the word to the next speaker.

The second group of columns quantifies the other elements that appear in the corpus texts. Namely, the transcripts also contain session or agenda titles, names of speakers or chairs etc., which have been, to varying extents, preserved in about half of the corpora and marked up as headings. The transcripts also contain many transcriber notes, i.e. remarks about time, voting, interruptions, applause, or unintelligible speech. Such commentary was identified and marked up in several ways. The default was to mark it up as notes (i.e. <note> , possibly with a type attribute specifying what kind), while the other option is to use more precise elements, the sum of which is shown in the "Incidents" column; these elements are <vocal> (non-lexical vocalised phenomena, e.g. exclamations from the auditorium), <kinesic> (non-vocalised communicative phenomena, e.g. applause) and <incident> (non-communicative phenomena, e.g. coughing), again, possibly using type to categorise these elements further. As can be seen, the corpora are not uniform in the treatment of these elements, most use both, but seven just notes, and one only incidents (BG); obviously, more work would be necessary to harmonise this encoding.

The last column gives the number of identified gaps in the corpora, which correspond to pieces of missing transcriptions, which are mostly due the transcriber noting that they could not understand or hear the speaker (e.g. because the microphone was not turned on), or, in certain cases that a part of the transcription was omitted by the corpus compiler, e.g. the table of contents or other tables. The two are distinguished by the value (inaudible vs. editorial) of their reason attribute. It should be noted that the numbers in the Table are given from the "plain-text" version of the corpus. The linguistically annotated version should have the same numbers, except for gaps. Here, the annotation pipeline used for some corpora had problems with parsing very long sentences, which were therefore omitted from the corpus, and this was also marked up with the <gap> element.

## 4 ParlaMint II additions

In addition to improving the infrastructure of the project, increasing the number of corpora and extending them in time, ParlaMint II also introduced other additions to the corpora which we overview in this section.

### 4.1 Localisation

A perennial question with monolingual language resources is in which language the metadata of the resource should be in: either in English, to make it maximally useful in an international setting, or in the language of the resource, to enable researchers from the corresponding country (or region) to analyse the data in their native language, and to maintain language equality. The ideal, of course, is to have the metadata in both languages. Already in ParlaMint I, certain metadata (e.g. titles of sessions), was present in the main language of the parliament, as well as in English. In ParlaMint II, we made a concerted effort to improve the localisation of the metadata in several ways.

First, most ParlaMint taxonomies (legislature, speaker types, subcorpora and left-to-right political orientation) were translated to most of the 29 main ParlaMint languages, and are now maintained centrally. This avoids different naming of categories for different corpora and constitutes a highly multilingual resource which might be interesting for other purposes and researchers.

The second improvement was driven by the machine-translated corpus. As it is not very useful to have the transcriptions in English, but names of speakers and affiliated organisations in the Cyrillic or Greek alphabet, we added transliterated names to the corpora.[20]

The third improvement, enabled by the first two, was the localisation (or, rather, i18n of the scripts) of specific down-conversions of the corpora, in particular to the metadata TSV files, and to the vertical files. For the former, the corpus distributions now include the metadata files both in original language, as well as in English. For the latter, the individual ParlaMint corpora on the concordancers have their metadata in the original language, while the machine-translated corpus (cf. Sect. 4.3), as well as the aligned joint corpus of all the 29 corpora, have metadata in English.

## 4.2 Adding metadata

In ParlaMint II, we also added metadata on individuals and organisations that had been identified as potentially useful but were missing from the ParlaMint I corpora. In the corpora where this information was previously missing, we identified the ministers and added these time-stamped affiliations to the corresponding individuals (cf. the column Minister in Table 3 with 1,805 persons). Wikipedia, government websites, etc. served as sources of this information.

A much more difficult concept was the second addition (modelled as states of organisations), namely the political orientation of political parties (Erjavec et al. 2023). The first source for this addition was the Chapel Hill Expert Survey Europe (Jolly et al. 2022), in particular, the CHES[21] Trend File 1999–2019 and CHES 2019, which adds countries such as Norway (NO), Iceland (IS) and Turkey (TR). Together, these two CSV files contain 85 variables on a specific (political) position for each party identified and each year covered.

Although this dataset provides valuable expert data, it only partially covers the ParlaMint corpora: CHES does not include all ParlaMint countries and no

[20] Transliteration was done using Perl's `Lingua::Translit` module, choosing as the most useful (simple to input yet readable) `Streamlined System BUL` for BG, `DIN 1460 UKR` for UA, and `ISO 843` for GR.

[21] https://www.chesdata.eu/.

autonomous regions, its time span is shorter, it does not include all political parties, and not all variables are available for all parties or years. In addition, the CHES dataset provides numerical values for its numerous variables,[22]

For these reasons we also added a simpler set of discrete categories for political orientation but with a wider coverage, namely, political orientation on the left-to-right (L-R) axis. While this distinction is somewhat simplistic and only expresses the political orientation in one dimension, it is nevertheless widely used and can provide valuable insights. To obtain the categories, we used Wikipedia, which covers most parties and usually provides information on the party's L-R orientation in the infobox. Wikipedia distinguishes 13 positions along this axis (Far-left, Left to far-left, Centre-left to left etc.) and another 5 that fall outside this continuum (e.g. Big Tent, Pirate Party). Using this approach, we were able to assign the L-R orientation to 892 of the 999 parties and parliamentary groups, i.e. we achieved a coverage of 89.3%. To enable an even wider coverage, we have also implemented the option for the encoders of the corpora to add the L-R information themselves, although only a few have made use of this option, namely BE, PT and UA.

From a technical perspective, the addition of the metadata was done centrally, using a method that was tested already in ParlaMint I (for markup of coalition/opposition information), namely that the metadata is not inserted directly into the ParlaMint-encoded (i.e. TEI/XML) files of the corpus, but indirectly via TSV files. The workflow for adding each additional metadata dimension consists of three steps. First, a script is written that converts the already existing metadata (if any) in a corpus into a TSV file and initialises the TSV file by writing the header line and e.g. one political party name per line. The encoder then imports the TSV file into their preferred spreadsheet editor, enters the required data and exports it as a TSV file. Adding the metadata to the TSV file can of course also be done automatically when the appropriate inputs are made, as was the case with the CHES orientations (although the country and party identifier mapping was done manually). The last step of the pipeline again consists of a script that checks the validity of the new TSV metadata[23] and merges it into the corresponding XML file of a corpus (either that for `<listPerson>` or for `<listOrg>`).

This approach allows the encoder of the additional metadata to focus on the information to be entered rather than the intricacies of its XML encoding, and may also be useful in the future for adding further metadata that can be easily expressed in a tabular format. Kryvenko and Kopp (2023) highlight the significant benefits of this approach for UA corpus development, with the most important advantages being the facilitation of collaboration between humanities scholars and computer scientists and a clear distinction between automatic and manual data entry.

[22] One of the CHES variables is `lrgen` i.e., the general position of a party on the L-R axis.

[23] Unfortunately, spreadsheet editors often silently change data and export it in a non-transparent way.

### 4.3 Machine translation and semantic annotation

To further benefit from the comparability and interoperability of the corpora and provide researchers with a possibility for investigating parliamentary phenomena across all ParlaMint corpora, the ParlaMint II project included the machine translation of the corpora into English, as well as semantic tagging of the translated corpora.

Machine translation[24] (MT) was performed with the pre-trained Transformer-based OPUS-MT models (Tiedemann and Thottingal 2020). These models are built upon the MarianNMT neural machine translation toolbox (Junczys-Dowmunt et al. 2018) and were trained on parallel corpora from the OPUS repository (Tiedemann 2012). The OPUS-MT models are either specialised for a specific language, such as models for Polish, or for a language family, such as models for South Slavic languages. The models for a language group were especially useful for cases where the corpus comprised debates in multiple related languages, such as Ukrainian and Russian in UA, or Catalan and Spanish in ES-CT. In contrast, if the corpora consisted of non-related languages, such as Dutch and French in BE or Spanish and Basque in ES-PV, they had to be split into two parts and processed separately. Prior to machine translation of the full corpora, a manual evaluation of samples machine-translated with all the available models were performed by the partners for each of the 30 languages to determine which model provides the best results for each language.

The pipeline to produce the machine-translated English ParlaMint corpora involves several steps. First, the speeches are extracted from the CoNLL-U files, and the transcriber notes from the ParlaMint-encoded files. Then, the notes and the sentences of the texts are machine-translated to English using the EasyNMT[25] library. To address the frequent inaccurately translated proper nouns, a post-processing step is performed by aligning[26] proper nouns with named entities extracted from the CoNLL-U files, using their lemmas as surface forms in the English translation. The translated corpora were then linguistically processed using the Stanza pipeline (Qi et al. 2020) on the same levels as the source-language corpora, except for syntax, which was too computationally demanding. For all levels, the default Stanza models were used which are trained on a combination of English Universal Dependencies datasets (Silveira et al. 2014; Zeldes 2017; Behzad & Zeldes 2020; Nivre et al. 2017; Monarch and Munro 2021), except for the named entities for which we used the CoNLL03 model (Tjong Kim Sang and De Meulder 2003) with 4 NER labels.

The already mentioned preliminary evaluation, despite being conducted on small samples, provided valuable insights into the translation quality. Overall, the machine translation output was found to be of high quality, however, approximately 20–30 % of the sentences still contained common machine translation errors. The errors can be on the word level, such as very frequent incorrect translations of proper nouns (e.g., *The Winner of the Welcomes* instead of *Zmago Jelinčič Plemeniti*, the name of

[24] The code for the MT pipeline is available at https://github.com/TajaKuzman/Parlamint-translation.

[25] https://github.com/UKPLab/EasyNMT.

[26] Word alignment was performed with https://github.com/robertostling/eflomal.

a Slovenian politician) or incorrect translation of terms (e.g., *State Assembly* instead of *National Assembly*). Errors can also occur at the level of multi-word expressions (e.g., literal translation of *Besedo dajem* to *I give my word to* instead of *I give the floor to*), or at the utterance level, where we observed repetitions, additions, and hallucinations, that is, MT output that is not related to the source text. Therefore, it is crucial for any studies using translated corpora to clearly outline the limitations of using machine-translated content and to cross-check the findings with the source texts.

Semantic annotation of corpora can take multiple forms, including Word Sense Disambiguation (WSD) where an existing detailed ontology or taxonomy of fine-grained word senses is employed as a label set and one sense per word is assigned to each particular context using a variety of disambiguation methods to resolve ambiguity due to homonymy and/or polysemy. In general, semantic annotation can be useful for further tasks in an NLP pipeline or for improving accuracy in applications such as information retrieval.

Our approach for ParlaMint II assigns coarse-grained semantic field labels from an existing tagset of 21 major top level domains (including 'emotion', 'money and commerce', and 'world and environment') at the top of a hierarchy splitting into 232 semantic tags.[27] The process used the UCREL Semantic Analysis System (USAS),[28] originally developed in C in the 1990 s for English semantic annotation (Rayson et al. 2004) but recently released open source for multiple languages in the Python Multilingual UCREL Semantic Analysis System (PyMUSAS).[29] The English system relies on large manually created lexicons of single words and multiword expressions (MWEs),[30] and is around 91% accurate for English, annotating a variety of MWEs including phrasal verbs, noun phrases, proper names, named entities, multiword prepositions as well as non-compositional idiomatic expressions, which all receive one semantic tag across the whole MWE. Contextual disambiguation methods for the semantic tagger rely on a number of methods including part-of-speech tagging for filtering the range of semantic tags being considered, general likelihood ranking and heuristics for overlapping MWE resolution. On a practical level, the PyMUSAS pipeline includes a spaCy[31] PoS tagger, and for ParlaMint we applied it to the translated CoNLL-U files. The PyMUSAS annotation was highly parallelised on the Oracle Compute cloud taking approximately 12 h for the whole corpus.[32]

As the final step in MT and semantic annotation, the original language ParlaMint-encoded corpora were first pre-processed to remove the content of all the sentences and transcriber notes, and to move the latter from inside the sentences to their beginning. Then the translated notes and additionally semantically annotated CoNLL-U

[27] https://ucrel.lancs.ac.uk/usas/USASSemanticTagset.pdf.

[28] https://ucrel.lancs.ac.uk/usas/.

[29] See https://pypi.org/project/pymusas/ and https://github.com/UCREL/pymusas.

[30] The lexicons for English and other languages are available for academic use with a Creative Commons licence, see https://github.com/UCREL/Multilingual-USAS.

[31] https://spacy.io/.

[32] We adapted a PyMUSAS CoNLL-U tagging script developed by Daisy Lal which is available at https://github.com/UCREL/pymusas-conllu-parlamint.

files were ParlaMint-encoded and inserted into the pre-processed corpora, i.e. into the empty transcriber notes and sentences. These corpora were then finalised using the common pipeline for corpus compilation (cf. Section 2.4.) but with slight changes in the metadata, i.e. the language of the corpus, specifying that these are machine-translated corpora, and adding the taxonomy for USAS semantic tags.

With this pipeline, the machine-translated and semantically annotated corpora are structured identically to the original ParlaMint corpora and also retain all their metadata. The resulting corpora are made available similarly to the original corpora, i.e. for download from the repository (Kuzman et al. 2024), and for analysis via the concordancers. For the concordancers, the ParlaMint corpora were joined into one corpus containing all the original language corpora, and one corpus containing all the machine-translated corpora, with both corpora constituting a parallel corpus aligned on the sentence level, and both with English language metadata.

## 4.4 Spoken corpora

Spoken corpora are typically expensive to construct and difficult to distribute as they have to be manually transcribed and contain biometric data. For ParlaMint corpora, neither applies: transcriptions are already available through the ParlaMint corpora, and, for many countries, the parliamentary audio/video is publicly available.

In ParlaMint II, we compiled pilot spoken corpora for four ParlaMint languages. Four datasets have been released so far, and they are detailed in Table 5.

The beginning of the Czech spoken corpus construction (Kopp et al. 2021) predated ParlaMint II and was tailored to their specific data. The ParCzech 4.0 corpus (Kopp 2024b) implemented the alignment procedure and, along with audio AudioPSP 24.01 (Kopp 2024a) comprised 4,590 h of audio and 1,976,928 sentences. ParlaSpeech-CZ features a well-aligned subset of sentences from ParCzech.

On the other hand, the Croatian, Polish and Serbian corpora were compiled with a novel robust pipeline (Ljubešić et al. 2024) which can align a large collection of recordings with a large collection of transcripts, given no previous alignment, not even at the level of files. An early version of the alignment pipeline, along with the description of the pre-pilot Croatian ParlaSpeech-HR 1.0 corpus (Ljubešić et al. 2022) is described in (Ljubešić, Koržinek, Rupnik, and Jazbec, 2022), while the current alignment pipeline is described in (Ljubešić, Rupnik, and Koržinek, 2024). The alignment is complicated for several reasons: the transcripts do not have the same order as recordings, not all recordings are transcribed, nor all of those made public, and the transcripts sometimes follow the spoken word very vaguely (redaction, gaps, mistakes). To work around these issues, while scaling to thousands of hours of recordings and tens of millions of words of transcripts, our pipeline has the following steps. Voice activity detection is performed first and speech representations are extracted with a Transformer model. These representations are used to produce automatic transcripts. The ParlaMint transcripts are simplified and approximately matched to the generated transcripts. The best matching candidates are realigned on the word level with the help of speech representations. Finally, the word-level

**Table 5** Currently available spoken parliamentary corpora including the corpus country (ID), name of the corpus, the number of hours of spoken data, the number of sentences covered and the reference to the dataset

| ID | Corpus name | Hours | Sentences | Data |
|---|---|---|---|---|
| CZ | ParlaSpeech-CZ 1.0 | 1,218 | 717,682 | (Kopp & Ljubešić 2024) |
| HR | ParlaSpeech-HR 2.0 | 3,061 | 922,679 | (Ljubešić et al. 2024) |
| PL | ParlaSpeech-PL 1.0 | 1,010 | 535,465 | (Koržinek & Ljubešić 2024) |
| RS | ParlaSpeech-RS 1.0 | 896 | 290,778 | (Ljubešić et al. 2024) |

alignment is used to re-segment the matches to follow the ParlaMint transcript segmentation into speeches and segments.

The resulting ParlaSpeech corpora consist of audio segments that correspond to specific sentences in the transcripts. The transcripts contain word-level alignments to the recordings, allowing for simple further segmentation of long sentences into shorter segments for memory-sensitive applications. Each segment has a reference to the ParlaMint 4.1 corpus via utterance IDs and character offsets.

The spoken corpora are not only available for download but also through the concordancers, where sentences are, for easier listening, further segmented into speech segments of up to 6 s around the concordance key. Finally, the corpora are made available through the HuggingFace Datasets,[33] allowing for simple usage of the data for fine-tuning Transformer models for automatic speech recognition or any other speech-related task.

## 5 Conclusions

The paper presented the current version of the ParlaMint corpora, including the infrastructure that enabled their compilation, and focusing on the additions achieved in the ParlaMint II project. Comprising 29 carefully structured corpora of parliamentary proceedings with over a billion words, significant metadata about the speakers, linguistic annotations, semantically-annotated machine translation to English, and featuring pilot speech corpora, the ParlaMint corpora should be a very valuable resource for anybody studying parliamentary discourse, especially in a comparative setting.

In addition to the presented work on the corpora, the ParlaMint II project also undertook dissemination activities. In 2023, two tutorials were given on the specifics and usage of ParlaMint corpora, one at the Digital Humanities conference in Graz (Kryvenko et al. 2023) and the other at the European Summer University in Digital Humanities (Kryvenko & Pahor de Maiti 2023). The ParlaMint corpora were also used in tasks in the scope of three Helsinki Digital Humanities Hackathons. In

[33] The HuggingFace ParlaSpeech dataset collection can be accessed at https://huggingface.co/collections/classla/parlaspeech-670923f23ab185f413d40795.

2022, a multi-disciplinary team investigated power distribution inside parliamentary networks using ParlaMint I corpora for GB, SI and ES, and with a special focus on gender distribution in the debates (Skubic et al. 2022). In 2023, using a draft edition of ParlaMint II corpora for GB, HU, SI and UA, the team investigated political polarisation, focusing on the topics of European Union, the war in Ukraine, and healthcare (Kryvenko, Evkoski, et al. 2023). In 2024, using the ParlaMint 4.0 corpora, the topic was titled “Echoes of the Chambers: Studying Democracy through Parliamentary Speeches”.[34] The ParlaMint II project was also presented to a large audience at the January 2024 “CLARIN Cafe”.[35]

Finally, a shared task using ParlaMint corpora with the title “Ideology and Power Identification in Parliamentary Debates” was held at CLEF 2024.[36] The shared task used a sample of ParlaMint II corpora (see Çöltekin et al. 2024, for details of the sampling process). The task attracted over 30 registered teams, 9 of which submitted results and papers describing their participation (Kiesel et al. 2024). A re-run of the task with improvements has been accepted for CLEF 2025.[37]

As regards further work, there would be a number of directions worth taking. First, it would be satisfying to fill in the grey areas presented in Fig. 1, i.e. add the still missing European countries (and autonomous regions) to the ParlaMint set of corpora. Second, the current set of ParlaMint corpora mostly ends mid-2022, and it would be, of course, worthwhile to add the transcripts since then. For the new corpora, sites willing to get to grips with the ParlaMint encoding and compilation would need to be found, while for extending existing corpora the existing pipelines would most likely be able to handle the new transcripts, however, the addition of metadata (new terms, speakers and political parties) would most likely have to be added manually. Third, ParlaMint has centrally produced the machine-translated and semantically-annotated versions, which would also need to be compiled for new or extended corpora. And fourth, ParlaMint has centrally added metadata, in particular the CHES datasets, currently reaching only 2019. The CHES datasets have recently been updated,[38] and it would be beneficial to include this new information into ParlaMint, as well as extending such metadata with other sources, such as V-Dem[39] (Coppedge et al. 2020). It is the very richness of metadata and the annotations that makes the ParlaMint corpora difficult to maintain, and a synchronised effort to extend the ParlaMint corpora in number, time and metadata is most likely dependent on a new project that would support this effort.

Another, easier approach might be to develop “ParlaMint-light” corpora, i.e. corpora that are ParlaMint-encoded, and can therefore take advantage of the validation and conversion software, but might be lacking much of the metadata or annotations.

[34] https://www.helsinki.fi/en/digital-humanities/dhh24-hackathon/dhh24-themes.

[35] https://www.clarin.eu/event/2024/clarin-cafe-parlamint.

[36] https://clef2024.clef-initiative.eu.

[37] https://touche.webis.de/clef25/touche25-web/ideology-and-power-identification-in-parliamentary-debates.html.

[38] In particular with “2023 SPEED CHES – Ukraine” and “2020 SPEED CHES – Covid”, cf. https://www.chesdata.eu/ches-europe.

[39] https://v-dem.net/.

This could be achieved relatively easily by relaxing the validation procedure, developing scripts to convert existing parliamentary corpora to ParlaMint, manually adding only basic information about the parliament, and annotating the transcripts with e.g. UD-Pipe. This light approach could be applied to some of the European countries missing from ParlaMint but for which corpora already exist, such as Germany (Blätte & Blessing 2018), Ireland (Sylvester et al. 2022) or Slovakia (Mochtak 2022). Such corpora would not be as richly annotated as the current crop but could nevertheless be a valuable addition to ParlaMint.

Still, probably currently, the most important part of future work does not concern the enhancement of the corpora but encouraging their use, esp. in the disciplines where the use of general purpose corpora is still rare, such as in political science or history.

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**Author contribution** T. Erjavec wrote Sects. 1, 2 (except for 2.3), and most of 5. In the project, he was the co-leader of the work package WP1: Documentation, interoperability, metadata and lead of WP2: Corpus expansion. He performed most of the work in the tasks T1.1: Harmonisation of encoding and T2.3: Data distribution and oversaw the work in T1.3: Adding metadata to existing corpora, T2.1: Adding new corpora and T2.2: Extending existing corpora. M. Kopp prepared the Figures and Tables in the paper. He was the co-leader of the work package WP1: Documentation, interoperability, metadata, where he was involved in tasks T1.1: Harmonisation of encoding. He performed most of the work in task T1.2: Git management and oversaw tasks T2.1: Adding new corpora and T2.2: Extending existing corpora. He produced the ParlaMint-CZ and ParlaMint-UA corpora and contributed to ParlaMint-ES. N. Ljubešić wrote Sect. 4.4. He was the lead of WP3: Corpus enrichment and led task T.3.2: Multimodality. He was involved in the production of the ParlaMint-BA, ParlaMint-BG, ParlaMint-HR, ParlaMint-SI, and ParlaMint-RS corpora. T. Kuzman wrote the machine translation part of Sect. 4.3. She performed the complete MT, as part of T3.1 Machine translation and semantic tagging. P. Rayson wrote the semantic annotation part of Sect. 4.3. He led the semantic annotation task in T3.1 Machine translation and semantic tagging. He led the production of the ParlaMint-GB corpus. P. Osenova wrote the dissemination part of Sect. 5. She was the co-leader of WP5: Coordination and was central to the tasks T5.1: Management and T5.2: Dissemination. She led the production of the ParlaMint-BG corpus. M. Ogrodniczuk was the co-leader of WP5: Coordination and was central to the tasks T5.1: Management. He led the production of the ParlaMint-PL corpus. Ç. Çöltekin was the co-leader of WP4: Engagement activities and had the sole responsibility for T4.3: Shared task. He led the production of the ParlaMint-TR corpus. D. Koržinek performed a significant part of the work on task T3.2: Multimodality. K. Meden helped write the Sects. 2.2 and 4. In the project, she helped with task T1.1: Harmonisation of encoding and contributed to task T1.3: Adding metadata to existing corpora. She led the production of the ParlaMint-SI corpus. J. Skubic performed most of the work in T1.3: Adding metadata to existing corpora. P. Rupnik compiled the ParlaMint-BA, ParlaMint-HR, and ParlaMint-RS corpora and participated in the work on task T3.2: Multimodality.

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**Availability of data and materials** The research data described in this paper are available for download under one of the Creative Commons licences.

**Code availability** The code and other components associated with the work described in this article are available via the project’s Github repository as Open Source.

## Declarations

**Competing interest** The authors have no Conflict of interest, nor Conflict of interest to disclose, neither financial nor any other. One of the authors is a member of the editorial board of this journal.

**Ethical approval** Not applicable / The provider of this data and related work declares that, to the best of their knowledge, it is free of copyright restrictions and does not contain sensitive personal information or violate privacy laws.

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## Authors and Affiliations

**Tomaž Erjavec[1] · Matyáš Kopp[2] · Nikola Ljubešić[1,9] · Taja Kuzman[1] · Paul Rayson[3] · Petya Osenova[4] · Maciej Ogrodniczuk[5] · Çağrı Çöltekin[6] · Danijel Koržinek[7] · Katja Meden[1,8,9] · Jure Skubic[9] · Peter Rupnik[1] · Tommaso Agnoloni[10] · José Aires[11] · Starkaður Barkarson[12] · Roberto Bartolini[13] · Núria Bel[14] · María Calzada Pérez[15] · Roberts Darģis[16] · Sascha Diwersy[17] · Maria Gavriilidou[18] · Ruben van Heusden[19] · Mikel Iruskieta[20] · Neeme Kahusk[21] · Anna Kryvenko[9,22] · Noémi Ligeti-Nagy[23] · Carmen Magariños[24] · Martin Mölder[25] · Costanza Navarretta[26] · Kiril Simov[4] · Lars Magne Tungland[27] · Jouni Tuominen[28] · John Vidler[3] · Adina Ioana Vladu[24] · Tanja Wissik[29] · Väinö Yrjänäinen[30] · Darja Fišer[9]**

✉ Tomaž Erjavec
tomaz.erjavec@ijs.si

✉ Matyáš Kopp
kopp@ufal.mff.cuni.cz

✉ Petya Osenova
petya@bultreebank.org

Nikola Ljubešić
nikola.ljubesic@ijs.si

Taja Kuzman
taja.kuzman@ijs.si

Paul Rayson
p.rayson@lancaster.ac.uk

Maciej Ogrodniczuk
maciej.ogrodniczuk@ipipan.waw.pl

Çağrı Çöltekin
ccoltekin@sfs.uni-tuebingen.de

Danijel Koržinek
danijel@pja.edu.pl

Katja Meden
katja.meden@ijs.si

Jure Skubic
jure.skubic@inz.si

Peter Rupnik
peter.rupnik@ijs.si

Tommaso Agnoloni
agnoloni@igsg.cnr.it

José Aires
jagc@edu.ulisboa.pt

Starkaður Barkarson
starkadur.barkarson@arnastofnun.is

Roberto Bartolini
roberto.bartolini@ilc.cnr.it

Núria Bel
nuria.bel@upf.edu

María Calzada Pérez
calzada@uji.es

Roberts Darģis
roberts.dargis@lumii.lv

Sascha Diwersy
sascha.diwersy@univ-montp3.fr

Maria Gavriilidou
maria@athenarc.gr

Ruben van Heusden
r.j.vanheusden@uva.nl

Mikel Iruskieta
mikel.iruskieta@ehu.eus

Neeme Kahusk
neeme.kahusk@gmail.com

Anna Kryvenko
ganna.kryvenko@inz.si

Noémi Ligeti-Nagy
ligeti-nagy.noemi@nytud.hun-ren.hu

Carmen Magariños
mariadelcarmen.magarinos@usc.gal

Martin Mölder
martin.molder@ut.ee

Costanza Navarretta
costanza@hum.ku.dk

Kiril Simov
kivs@bultreebank.org

Lars Magne Tungland
lars.tungland@nb.no

Jouni Tuominen
jouni.tuominen@helsinki.fi

John Vidler
j.vidler@lancaster.ac.uk

Adina Ioana Vladu
adina.vladu@usc.gal

Tanja Wissik
tanja.wissik@oeaw.ac.at

Väinö Yrjänäinen
vaino.yrjanainen@statistik.uu.se

Darja Fišer
darja.fiser@inz.si

[1] Department of Knowledge Technologies, Jožef Stefan Institute, Ljubljana, Slovenia

[2] Institute of Formal and Applied Linguistics, Faculty of Mathematics and Physics, Charles University, Prague, Czech Republic

[3] UCREL NLP research group, Lancaster University, Lancaster, UK

[4] Institute of Information and Communication Technologies, Bulgarian Academy of Sciences, Sofia, Bulgaria

[5] Institute of Computer Science, Polish Academy of Sciences, Warsaw, Poland

[6] University of Tübingen, Tübingen, Germany

[7] Department of Multimedia, Polish-Japanese Academy of Information Technology, Warsaw, Poland

[8] Jožef Stefan International Postgraduate School, Ljubljana, Slovenia

[9] Institute of Contemporary History, Ljubljana, Slovenia

[10] Institute of Legal Informatics and Judicial Systems, CNR, Firenze, Italy

[11] School of Arts and Humanities - Centre of Linguistics, University of Lisbon, Lisbon, Portugal

[12] Department of Icelandic, The Árni Magnússon Institute for Icelandic Studies, Reykjavík, Iceland

[13] Istituto di Linguistica Computazionale, CNR, Pisa, Italy

[14] Department of Translation and Language Sciences, Pompeu Fabra University, Barcelona, Spain

[15] Departamento de Traducción y Comunicación, Universitat Jaume I, Castellón, Spain

[16] IMCS at the University of Latvia, Riga, Latvia

[17] Praxiling UMR 5267 CNRS, Paul Valéry University Montpellier 3, Montpellier, France

[18] Athena Research & Innovation Center in Information Communication & Knowledge Technologies, Athens, Greece

[19] Information Retrieval Lab, University of Amsterdam, Amsterdam, The Netherlands

[20] HiTZ Basque Center for Language Techonology, Ixa, University of the Basque Country (UPV/EHU), Bilbao, Spain

[21] Institute of Computer Science, University of Tartu, Tartu, Estonia

[22] NISS, Kyiv, Ukraine

[23] Language Technology Research Group, HUN-REN Hungarian Research Centre for Linguistics, Budapest, Hungary

[24] Galician Language Institute, University of Santiago de Compostela, Santiago de Compostela, Spain

[25] Johan Skytte Institute of Political Studies, University of Tartu, Tartu, Estonia

[26] Department of Nordic Studies and Linguistics, University of Copenhagen, Copenhagen, Denmark

[27] National Library of Norway, Oslo, Norway

[28] Helsinki Institute for Social Sciences and Humanities, University of Helsinki, Helsinki, Finland

[29] Austrian Centre for Digital Humanities and Cultural Heritage, Austrian Academy of Sciences, Vienna, Austria

[30] Department of Statistics, Uppsala University, Uppsala, Sweden